Claims

[c1] 1.A magnetic trip unit for actuating a latching mechanism to trip a circuit breaker upon an overcurrent condition, the magnetic trip unit including:
an electrically conductive strap;
a flux return component in electromagnetic communication with said electrically conductive strap;
a tube disposed within said flux return component;
a stator disposed at a first end of said tube connected to said flux return component, said stator having a stator surface at one end; and
a plunger slidably extending from a second end of said tube, said plunger includes a plunger surface at one end facing said stator surface, said plunger further includes another end adapted to operably interact with the latching mechanism, said plunger is biased to a predetermined position.

[c2] 2.The magnetic trip unit of claim 1, wherein said predetermined position is defined by a gap between said plunger surface and said stator surface.

[c3] 3.The magnetic trip unit of claim 1, wherein said plunger surface comprises a convex conical surface and said stator surface comprises a complementary concave conical surface to operably receive said plunger surface.

[c4] 4.The magnetic trip unit of claim 1, wherein said plunger surface comprises a concave conical surface and said stator surface comprises a complementary convex conical surface to operably receive said plunger surface.

[c5] 5.The magnetic trip unit of claim 2, wherein said plunger surface and said stator surface are each configured having a complementary conical shape, said complementary conical shape providing a generally linear relationship between said gap and an induced magnetic force acting on said plunger at large gaps relative to small gaps.

[c6] 6.The magnetic trip unit of claim 1, wherein said flux return component includes a coil disposed around said tube in electrical communication with said electrically conductive strap.

[c7] 7.The magnetic trip unit of claim 1, wherein said bias includes a biasing

member operably connected to said plunger, said biasing member biasing said plunger away from said stator.

[c8] 8.The magnetic trip unit of claim 1, wherein said bias includes a spring biasing said plunger away from said stator, said plunger is biased in a predetermined position by a means for limiting further translation of said plunger away from said stator.

[c9] 9.The magnetic trip unit of claim 8, wherein said means for limiting further translation includes setting said gap between said plunger surface and said stator surface.

[c10] 10.A circuit breaker including:

a first contact arm arranged between first and second electrically conductive straps;

a latching mechanism configured to move said first contact arm out of contact with said first and second electrically conductive straps; and

a magnetic trip unit for actuating said latching mechanism to trip the circuit breaker upon an overcurrent condition, the magnetic trip unit including:

a flux return component in electromagnetic communication with said first electrically conductive strap;

a tube disposed within said flux return component;

a stator disposed at a first end of said tube connected to said flux return component, said stator having a stator surface at one end; and

a plunger slidably extending from a second end of said tube, said plunger comprises a plunger surface at one end facing said stator surface, said plunger further includes another end adapted to operably interact with said latching mechanism, said plunger is biased in a predetermined position.

[c11] 11.The circuit breaker of claim 10, wherein said predetermined position is defined by a gap between said plunger surface and said stator surface.

[c12] 12.The circuit breaker of claim 10, wherein said plunger surface comprises a convex conical surface and said stator surface comprises a complementary concave conical surface to operably receive said plunger surface.

[c13] 13.The circuit breaker of claim 10, wherein said plunger surface comprises a concave conical surface and said stator surface comprises a complementary convex conical surface to operably receive said plunger surface.

[c14] 14.The circuit breaker of claim 11, wherein said plunger surface and said stator surface are each configured having a complementary conical shape, said complementary conical shape providing a generally linear relationship between said gap and an induced magnetic force acting on said plunge at large gaps relative to small gaps.

[c15] 15.The circuit breaker of claim 10, wherein said flux return component includes a coil disposed around said tube in electrical communication with said first electrically conductive strap.

[c16] 16.The circuit breaker of claim 10, wherein said bias includes a biasing member operably connected to said plunger, said biasing member biasing said plunger away from said stator.

[c17] 17. The circuit breaker of claim 10, wherein said bias includes a spring biasing said plunger away from said stator, said plunger is biased in a predetermined position by a means for limiting further translation of said plunger away from said stator.

[c18] 18.The circuit breaker of claim 17, wherein said means for limiting further translation includes setting said gap between said plunger surface and said stator surface.